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## PROCESS FOR THE PRODUCTION OF PRE-STRESSED OR BENT GLASS ELEMENTS

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention.

[0001] The invention relates to pre-stressed or bent glass elements, especially window panes.

#### 2. Description of the Related Art.

[0002] Pre-stressed glass applications include glazing glass panes, automobile glazings such as wind protection panes, inlay bottom plates for refrigeration cabinets, inspection glass-windows for baking ovens, spherical caps, sanitary utensils, of instrument coverings, special-filtering glasses, etc.

[0003] Flat glass panes that are then bent are currently being used for many purposes. A few uses are, for example, building glazing-panes, automobile glazings, spherical caps, sanitary utensils, instrument coverings, etc.

[0004] The process for the production of pre-stressed glass elements comprises the following process steps:

[0005] First of all the glass body, such as a pane of glass is produced. The float process is typically used to produce glass panes, but glass panes can also be generated in another manner, for example in the drawing process or in the casting process.

[0006] There then follows the cutting of the glass plates to measure for the required end measurement; following the cutting-to-measure, a processing of the edges is required. The edges, namely, present irregularities such as microcracks. On arising of tensions, such

irregularities lead to a breaking out of glass in the edge zone or even to a propagation of the microcracks through the whole glass pane, and therewith to its breaking. For these reasons it is necessary to grind the edges of glasses before the pre-stressing, in order to avoid a breaking-out or breaking-through of the glass element in use.

**[0007]** Upon the edge treatment, in general a washing process must follow in order to remove the grinding residues of glass particles before the pre-stressing process.

**[0008]** The whole process is time consuming and expensive. This relates especially to the edge processing and the washing treatment. The edge treatment does not always lead to the desired result. After the cutting of the glass pane to the desired measurement, namely, hidden microcracks can be present, which extend relatively far into the glass surface, without this fact being perceptible in the edge process operation.

**[0009]** In the production of bent glass elements, the following process steps are typically applied:

**[0010]** Preparation of the glass elements (ordinarily) produced in the float process; the plates may, however, also be otherwise produced, for example in the drawing process or casting process

**[0011]** Cutting of the glass plates to measure to the required final dimension

**[0012]** Edge treatment (grinding process, optional)

**[0013]** Bending process

**[0014]** Possible pre-stressing process (depending on glass thickness and utilization, a thermal or a chemical process)

**[0015]** The sense of the edge processing lies in an improvement of yield in the bending process, for the avoidance of breakage and glass splinters. If (which is possible) the edge processing is dispensed with, there results correspondingly an increased waste during that process. In addition to the edge processing mentioned, ordinarily there must take place, before the bending process, a washing process for the removal of grinding residues and glass particles.

### SUMMARY OF THE INVENTION

**[0016]** Underlying the invention is the problem of providing a process for the production of bent and/or pre-stressed glass panes, in which the disadvantages mentioned above are

avoided. In particular, the present production process is simplified and less costly, and furthermore, the danger of the breaking-out or of the propagation of hair-like cracks is avoided. The process is in any case to be designed in such manner that it is possible to dispense with an edge treatment and a washing process.

[0017] This problem is solved by the features of claim 1.

#### DETAILED DESCRIPTION

[0018] In this context, the inventors have perceived the following: When the cutting of the glass plate measured to its desired final measurement is carried out by means of a laser, then an edge quality is yielded which is faultless with respect to thermal and mechanical loadability. The quality is equal to that which is achieved with conventional edge processing. By the use of a laser all hair-like cracks or microscopic breakouts from the material are avoided. The grinding of the edges is thus dispensed with. Simultaneously the necessity of the washing is eliminated. The saving in time and labor expenditure by the invention is, therefore, considerable.

[0019] Depending on the thickness of the glass plate to be cut, it can be possible to achieve the desired dimension of the glass plate by a laser-scratching or scoring process and the subsequent breaking of the glass plate. Tests have shown that even here a faultless edge quality is achieved.

[0020] The use of lasers for the cutting of materials is known, to be sure. But it was not to be expected that the cutting of glass plates present here would render unnecessary a reworking of edges and therewith also eliminate the necessity of washing. Without knowledge of this factual behavior, the conventional process described at the outset had to appear more rational.

[0021] If a glass pane is to be pre-stressed, then by means of a laser after the laser-scratching and the pressing through, it is pre-stressed in a usual manner. There, the workpiece passes through a run-through furnace or through a reversing furnace, and thereupon through a quenching arrangement. Here a pressure tension is applied in the outer zones, and in the inner zone a pull tension. The pre-stressing has, as is well known, the sense of enhancing the strength of glass panes and simultaneously, in the event of a breakage, to lead to a breakup of the glass pane into fine granules.

• **[0022]** If a glass pane is to be bent, then by means of a laser it is cut to format. An edge treatment with the appertaining washing process is eliminated.

**[0023]** Glass panes produced according to the invention--bent and/or pre-stressed--have a clearly higher cut-edge quality and an increased strength. Bent glass panes have all the advantages of glass panes that are produced according to known bending processes, without the necessity of an edge processing.

**[0024]** The invention can be applied to any types of glass bodies, for example, to complex bent glass panes, flat glass panes, and three-dimensional shapes.

**[0025]** The sequence of the process steps of "pre-stressing" and "bending" of the glass panes may be varied. In general however, the bending will precede the pre-stressing.